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AUTHOR Gonter, Martha A.
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ABSTRACT

The paper reports on a study of communication skills in twin infants, a deaf male and a hearing female, who have hearing impaired parents and an older deaf sibling. Videotapes of interaction in the home were transcribed and analyzed according to communication mode and pragmatic function. Findings suggested that both twins were somewhat delayed in certain areas of language development, even compared to deaf norms. The female exhibited a greater amount of communication than the male, perhaps indicating a more generalized perception of differences between the twin's operational styles. The beginnings of code switching behaviors were evidenced, especially in the female infant's apparent discrimination between interactors on the basis of communication modality. Pragmatic analysis revealed marked similarity in performance and congruence with what is known about language development of deaf and hearing children. (CL)

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Early Development of Vocal and Signed Language in Hearing and Deaf Fraternal Twins

Martha A. Gonter, Ph.D.
Department of Special Education
Bowling Green State University
Bowling Green, Ohio 4340

AERA, New Orleans, 1984

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EARLY DEVELOPMENT OF VOCAL AND SIGNED LANGUAGE

IN HEARING AND DEAF FRATERNAL TWINS

This paper reports the analysis of data from the first year of an ongoing longitudinal study of deaf and hearing fraternal twins of deaf parents. Observations were begun immediately after the twins were identified at 15 months, some time before the specific goals and methods for the study were formulated.

The handicap associated with deafness stems from interference with the normal acquisition of language. Since nearly ninety percent of deaf children are born to hearing parents, they do not naturally acquire a native (first) language. Historically, the deaf have experienced lifelong, severe language deficits leading to underachievement in education and employment.

By adulthood, most deaf persons have attained some skills in both English and American Sign Language (ASL). While English is required for literacy in a hearing society, sign language is the social and cultural bond within the deaf community. Given these facts, a few professionals have advocated a bilingual approach to education of the deaf (Cokely, 1979; Stokoe, 1976). Yet standard English and ASL represent not only two distinct languages but two separate modes of communication: aural/oral and visual/manual. Reluctance of educators regarding a bilingual approach centers on the diagnostic and language delay suffered by most deaf children. Bilingual instruction in what amounts to two non-native languages might only further interrupt the process of language acquisition (especially English).

Complicating the concern about language choice is the body of evidence demonstrating the benefits (for a deaf child) of having deaf

parents. Opportunity for early exposure to language (ASL) does not completely explain the superiority of such children across a broad range of educational, psychological, social, personal and career variables. Perhaps it is what deaf parents do when they interact that may hold the key to these children's success (Bodner-Johnson, 1982).

Current practice in education of the deaf relies heavily on classroom use, primarily by hearing teachers, of systems of manually coded English (MCE): sign codes for representing semantic and syntactic features of spoken English. The philosophical emphasis is on "total communication", the integration of MCE systems with traditional oral methods (speech and lipreading, etc.). Notions of communication, as opposed to language, and of the deaf learner as interactor are predominant. Studies of normal hearing children have highlighted both the role of interaction as a medium for language acquisition (Moerk, 1977; and Ochs & Schefflin, 1979) and the complex manner in which features of the communication context effect the nature and product of that interaction (Snow & Ferguson, 1977; Moerk, 1977). Communicative intent, style, and linguistic structure are manipulated by children, as well as adults, to suit requirements of situation and listener (Berko-Gleason, 1973; Cross, 1977; and Lieven, 1978). In their world, deaf youngsters must learn from a kaleidoscope of discourse with both deaf and hearing interactors, through both manual and vocal modalities and, for those with deaf parents, in two dissimilar languages. The common thread in this varied communication is the social and personal impetus to communicate.

"...the child communicates before he has language. He does so in order to carry out certain functions that are vital to the species. These primative communication acts are effected by gesture,

vocalization, and the exploitation of content" (Bruner, 1978, p. 65).

To date, most research that is pertinent to signed instructional methodology has been conducted with school-aged children. Usually such examinations have been restricted either to English or sign, to deaf or hearing environments and results have been confounded by the interaction of language and environment (deaf:sign/hearing:English). Furthermore, language analyses have focused principally on semantic and syntactic aspects and development. Results of ASL studies have revealed parallels to the development of spoken language(Klima & Bellugi, 1979; McIntire, 1977; Skarakis & Prutting, 1977). Studies of MCE have noted improvements in the English competencies of deaf students (Brasel & Quigley, 1977; Weiss, McIntyre, Goodwin & Moores, 1975). However, MCE effectiveness appears also to be related to age at intervention (Raffin, Davis & Gelman, 1978; Gonter, 1983) and to levels of parental skill and usage which are frequently not high due to the foreign nature of the signed medium (Crandall, 1978). Unfortunately, there is a very shallow information base upon which to formulate specific classroom intervention policies or parent training techniques, especially regarding the deaf child under the age of four. Only very recently have pragmatic features become the subject of sign research (Curtiss et al, 1979; Maestras y Moores, 1980; Miller, 1982; Van Metre & Maxwell, 1981). More information is needed to describe the deaf child as interactor relative to varying characteristics of the communication process and environment. Only whenthe development of communicative competencies, style and flexibility are outlined can realitic goals nd procedures for home or school interventon be formulated.

The present study is an empirical investigation of communication skills in twins, a deaf male and a hearing female who have

hearing-impaired parents and an older deaf sibling. The uniqueness of the subject family and the structure of the study environment provide opportunities to follow the concurrent development of speech and sign in an unusual communicative environment. Family and close social contacts, almost exclusively within the deaf community, provide for signed models and interactions. Ongoing contacts with hearing relatives, and the hearing observers, provide for models and interactions in vocal and manual English. Meanwhile, differences in environmental and rearing variables, which confound most comparisons of language systems between deaf and hearing subjects, have been minimized.

The foci of analysis early in the study (ages 16 - 24 months) have been pragmatic function and modality aspects of the various adult-child interactions. It is recognized that small N descriptive research is limited inferentially. It is believed that the longitudinal nature of the data will enhance the potential to derive interactional strategies which might then be used and evaluated in a more rigorous experimental fashion.

METHOD

Subjects

This case study involves a five-member family within the deaf subculture of a metropolitan area in Ohio. Dad, who is a factory laborer, lost his hearing at about age four as a result of illness. Though he has a severe loss, his early exposure to language and good speechreading ability enable him to function somewhat more easily with hearing non-signers than his wife does. He attended programs for the hearing impaired in a public school system and graduated from high school at age 20. In communicating, his linguistic variation ranges

from American Sign Language to spoken English, depending on his interactor. His use of voice is frequent and reasonably understandable to persons accustomed to deaf speech. He does not use a hearing aid.

Mom was adopted as an infant after her father died. The cause of her profound deafness is undetermined, though it is presumed she was deaf at birth. Her natural and adoptive parents and three natural siblings all had normal hearing. At first, she attended a public school program for the hearing impaired which emphasized oral language skills. She reports that she was unsuccessful in using speech and speechreading to communicate. From the age of nine until graduation, she attended a residential school for the deaf where she learned to sign. American Sign Language is her preferred form of communication. She relies on an interpreter or writing for communicating with non-signers. Her use of voice is infrequent and her speech is not intelligible.

Ann, 7 years older than the twins and profoundly deaf since birth, is the mother's child by a previous marriage. Her natural father is also deaf. Though exposed to sign language from infancy, mother reports that Ann did not use signs until the age of four when she began school. She first was fitted for a hearing aid at that time also. Ann previously attended both state and private institutions for the deaf as a resident student but currently is living with the family and is enrolled in public day classes. Generally, her role in study activities has been very limited.

The primary subjects of study are dizygotic twins, Terri (female) and Timmy (male). The study period extends through their ages of 16 - 24 months. Timmy is profoundly deaf (100+ db). Though mother attributes his hearing loss to illness and high fever at age two months, the immediate family history provides evidence of a genetic origin. He

was fitted for a hearing aid prior to initiation of the study, but use was reportedly postponed due to recurrent ear infections.

Terri, at age 15 months, was thought to have normal hearing. Speech was delayed but this was attributed to lack of stimulation. At age 3 1/2 a mild-moderate hearing impairment (50 db) was diagnosed, though by that time spoken language was developing. She was fitted with a hearing aid (not worn at home), and with it her speech thresholds appear to be nearly normal.

The twins were born one to two weeks prematurely, Timmy first and Terri minutes later. He was the larger of the twins at birth and years later exceeds her still in both stature and weight. Mother reports that motor development proceeded normally; Timmy first walked a couple of weeks prior to Terri and both demonstrate right-hand dominance. From the beginning, both children appeared to possess normal intellectual ability and mother reports that they learned at about the same rate. Socially, Timmy is initially more friendly with strangers than Terri, but generally spends less time interacting with adults and more time in solitary play than she does. Signs were used with the children from birth and both began to imitate signing behavior at about 16 months. Neither child gives evidence of any additional handicap.

Note: At intervals during the study, standardized measures of the twins' intellectual, social and motoric development have been obtained for purposes of better evaluating differences in language or communication behavior. The Minnesota Child Development Inventory (MCDI) was used to examine the children's social-adaptive development. The Inventory yields scale scores in the skill areas of: General Development, Gross Motor, Fine Motor, Expressive Language (sign), Comprehension Conceptual, Situation Comprehension, Self Help, and Personal/Social. Scores were obtained on five occasions (chron. age 22, 27, 34, 39, and 47 and 59 months). The children's parents served as informants for the inventory. They reported their responses to the items to a sign language intepreter, who recorded them on the answer sheet. This

inventory is believed to be a valuable descriptor of the children's social-adaptive skills. It is not being used as an indicator of normal social development because of its lack of extensive deaf norms.

The children's intellectual abilities were also examined on several occasions during their 60 months of life. The twins' ages at each testing were the same as for the five administrations of the MCDI. Several Intelligence Scales were used with the children, including: The Bayley Scales of Infant Development; The Cattell Infant Intelligence Scale; the Stanford-Binet Intelligence Scale, the Wechsler Preschool and Primary Scale of Intelligence; and the Leiter International Performance Scale. Tests were administered by trained Clinical Psychologists with the assistance of a sign language interpreter. During each testing session no more than two intelligence scales were administered to the children.

Collectively, these psychological measurements have shown the twins to possess similar general intellectual ability, with the latest tests indicating that both are above average. Expected discrepancies between performance on verbal versus nonverbal measures (lower verbal) are attributed to effects of hearing loss. More specifically, the testing series showed that: (1) in the area of fine motor development, Terri outperformed Timmy and both surpassed age (hearing) norms from the earliest measurement to the present. This advantage is attributed to early signing behavior; (1) in the areas of gross motor development, self-help skills, and situation comprehension, Timmy initially outperformed Terri and both surpassed age norms. Presently, they are at similar levels which are slightly below age norms; (3) in the areas of personal/social development and language (expression and comprehension) the twins have consistently performed at about the same levels. These levels have been below age (hearing) norms from the beginning. These deficiencies are attributed to a combinaion of hearing deficit and possibly effect of twinship.

Personnel, Equipment and Materials

In addition to the investigator, who is a certified teacher of the deaf and a fluent user of signed English, the study involved a graduate assistant, who is a hearing native signer of ASL and also certified to teach the deaf. Since it is in the nature of children to interact with anyone present, this shared fluency in sign permitted the investigator and assistant the flexibility to alternate interacting and recording roles.

Videotape recording was intially accomplished with a Sony one-half inch, reel-to-reel, black and white portable recorder and camera. Later, equipment consisted of a Panasonic one-half inch color cassette recorder (model NV8200) and portable color camera (model WV3320). This equipment produces good recordings under normal home lighting conditions. Also featured is the capability for frame-by-frame or slow motion playback.

Some stimulus items were brought to taping sessions by the investigator to supplement materials already available in the home. These provided some content continuity across time and allowed for interaction about novel, as well as familiar, objects and activities. These outside materials usually were preschool toys, educational kits, books, manipulative and art materials, selected sound producing items and occasionally testing materials.

Procedures

Videotaped samples were recorded at least once per month, usually for one hour, at the family home. Through the twins' age two, samples included occasional interaction with deaf neighbors and friends as well as family members and the hearing investigators. Most interactors used gesture and sign to some degree. Use of voice varied greatly. Activities were typical for preschool-aged children and included manipulative and social play, book sharing, snacks, holiday activities and, infrequently, personal hygiene. Emphasis was placed on natural communication occuring in these situations and the language common to them. The camera was placed at an advantageous location and usually left stationery and running continuously. Once the routine was familiar, these practices had the effect of lessening the intrusiveness of the equipment.

Analysis

Videotapes were transcribed to include contextual, nonverbal, vocal and sign content, and provide description or interpretation where necessary. In addition to this content, the English gloss had to accommodate the simultaneous capabilities of three-dimensional manual language, its incidence and gross timing. Two types of simultaneity were coded: first, the cooccurence of separate utterances by two or more interactors and second, the cooccurence of separate productions in one or more modalities by a single communicator (i.e., a word with a different sign, or different signs with each hand).

Transcription was accomplished using a General Transcription Code (see Appendix) which outlines procedures for specifying: the initiator and addressee of the utterance, the presence or absence of eye contact at the beginning of an utterance, the manual and/or vocal portions, pauses within an utterance as well as pauses while another signs, individual and interactive simultaneity, reduplication of elements, questioning intonation, utterance termination and a few specific notations not required for all utterances. Some elements of this notation system were adapted from a system used at the Salk Institute and reported by Reilly and McIntire (1980). Additional notation devices were developed by the investigator during past work with videotaped manual language samples. Transcripts were prepared by either the investigator or assistant and reviewed by the other. Correction or clarifications were then made.

Analyses of communication mode and pragmatic function for transcripts from 16 - 24 months have been completed. Examination of communication mode covered both receptive and expressive aspects with regard to each twin. Each communication to the children (receptive) and by the children (expressive) was classified as one of four types: (1) nonverbal which included headshakes and attention-getting devices, (2)

vocal only: words or interpretable approximations, (3) manual only: signs or interpretable approximations, deixis, etc., and (4) combined vocal and manual: speech (approximation) accompanying sign (approximation). Consider the following examples from a transcript:

"Can you find the" FOOD?/

The elements CAN and YOU were each spoken and signed simultaneously, "find, the" were spoken only, and FOOD was signed only. So, this communication, with both vocal and manual elements would have been coded as combined vocal manual modalities. Since the categories represent discrete phenomena, no difficulties were encountered with reliability (95 - 100%) and no uncodable instances were noted. Frequencies were tallied for each category and interactor for each month.

Due to the young age of the twins and the unpredictability of natural situations, low frequencies and zeros occurred for some interactors, categories and months. For further analysis, frequency data were collapsed in two ways. The nine months of study were divided into thirds, 16-18, 19-21, and 22-24 months respectively. The small number of irregular interactions (neighbors, etc.) was eliminated. Since Terri (TR) and Timmy (TM) produced a very small number of utterances to one another, the "to twin" totals of each twin were combined with the parent whose communication status was most similar: TR's with Dad (D) for TM's analysis and TM's with Mom (M) for TR's analysis.

For the pragmatic analysis, each twin communication was coded using a system which combined elements from Day (1982) and Greenberg (1980). Superordinate categories were identified: performative, request, response, description, statement, conversational device, miscellaneous (unclasifiable). In the case of utterances which were responses to questions double coding was used, one to identify the type of question (WH or yes/no) and the second to characterize the response itself.

Consider the following exchange from a transcript:

adult: "want another one?"/

twin: THIS (index baloon in bag)/

The twin response would have been coded YNR/REF to indicate the yes-no nature of the question and the referent nature of the response. Double coding of responses solved the only significant discrepancy between coders. Other instances of disagreement were resolved by a conference. Frequencies were then tallied for each category for each month.

Again, due to low and zero frequencies for some categories, frequency tables were collapsed in two ways. The study period was divided into the same three time segments, 16-18, 19-21 and 22-24 months. Within each superordinate category, one or two of the subcategories accounted for an overwhelming frequency of occurences. Consequently, each pragmatic category was collapsed into two subsets, one consisting of the most frequently occuring subfunction(s) and the other consisting of all other subfunctions.

RESULTS

This study of preschool twin children focused on early communicative processes in a deaf environment. In particular, the aim was to probe the effects of hearing status on pragmatic aspects of language development: form and function. This report highlights the twins' communicative behavior rather than their linguistic output. The twins interacted with both hearing and deaf adults, through both vocal and manual channels, and in two languages, ASL and English. Unlike most deaf-hearing comparisons, however, the subjects of this study otherwise shared the same rearing environment as well as communication situations and opportunities.

Overall, the volume of communication from all interactors to the hearing female, TR (956 utterances) exceeded that to the deaf male, TM (733 utterances). At the same time, utterance production to all

interactors over the nine-month period of study, was greater for TR (672 utterances) than for TM (454 utterances).

Modality

One aspect of the unique study circumstances, which seemed worthy of early analysis was communication modality. Would the types of input to the twins vary? More specifically, would the proportions of vocal to manual communication vary as a function of their hearing status? How might these receptive aspects compare with the expression of modality by the twins. The transcripts were coded for modality (see transcript example 2/25/81); each adult and child utterance classified as gestural, vocal only, manual only or vocal and manual combined.

Data for modality use by all interactors are presented in Summary I. The information is divided into communications received by the twins from various interactors and those expressed by the twins to Mom, Dad and Hearing observers. Under receptive and expressive headings for each twin, frequencies of communication are subcategorized by modality and interactor. In TR's case, TM's few utterances to her were combined with M's because, like Mom, he is profoundly deaf. In TM's case, TR's few utterances to him were combined with D's because, like Dad, she has useable hearing. Totals of hearing interactors were also collapsed.

To obtain a fundamental comparison of differences in input (%T) to the twins the categories labeled gestural, manual, and combined were totalled to represent 'manual' input. 'Vocal' input was obtained by totalling the categories labeled vocal and combined. Percentages rather than frequencies were used in order to accommodate differences between twins in total number of utterances. Across the months, the 'manual' input to the deaf male exceeded that to the hearing female and exceeded the 'vocal' input to him. Conversely, 'vocal' input to the hearing

female exceeded that to the deaf male as well as the 'manual' input to her. Finer details exemplify this basic difference: manual only input to TM was twice that to TR (12% to 6%), while vocal only input to TR almost doubled that to TM (7% to 4%).

Individually, for TM, the ratio (%T) of 'vocal' to 'manual' input from all interactors remained fairly stable across time: 65/95 at 16-18 months, 81/86 at 19-21 months and 54/92 at 22-24 months. The change at time 2 was a function of a disproportionate increase in frequency of interaction with hearing observers (almost all the vocal only input to TM was from hearing interactors). TM's ratio of 'vocal' to 'manual' output to all interactors was even more fixed: 0/100 at 16-18 months, 3/97 at 19-21 months and 1/99 at 22-24 months.

An analysis of TM's interactors, labeled %I, revealed that, across time, communication from Dad was most often manual only (36, 57. 80%) followed by combined. From Mom, communication was most often manual only (56, 100, 52%) followed by combined. The great majority of utterances from hearing interactors to TM combined vocal and manual modalities simultaneously (85, 76, 53%) with the next most used modality changing from vocal only initially to manual only by the time he reached 24 months. TM's expressive modality to all interactors was nearly always manual only. His very few utterances with a vocal component (N=6) were to hearing interactors, though all interactors had vocalized to him at some time.

Individually, for TR also, the ratio (%T) of 'vocal' to 'manual' input from all interactors was fairly stable over time: 80/76 at 16-18 months, 82/77 at 19-21 months and 69/83 at 22-24 months. The variation at time three resulted from a switch from vocal only to combined communication by hearing interactors and a substantial increase in manual

only communication by Mom. In contrast, TR's ratio of 'vocal' to 'manual' output to all interactors varied significantly over the study period. At 16-18 months, it was 23/85; at 19-21 months the ratio shifted to 32/78 and finally to 12/95 at 22-24 months. The greatly reduced ratio at time three appears to be accounted for in large measure by a change in her communication to hearing interactors, from combined to manual only.

An analysis of TR's interactors (%I) showed that, over time, hearing interactors most frequently communicated with her using combined vocal and manual modalities (55, 66, 62%) with their second most frequent modality being vocal only. Dad communicated with TR most often like the hearing interactors, by using combined modalities (56, 34, 31%). His second most frequent modality varied between vocal only and manual only. TR's input from Mom changed from the combined modality early (56%) to manual only (70%) by 24 months. From the beginning, TR used a broader range of expressive modalities across interactors than her twin. The most frequent overall and highest at 24 months was manual only. Use of the other three categories varied. She used a greater percentage of both vocal only and combined to hearing interactors than to her parents and usually a greater percentage of these vocal categories to Dad than to Mom.

Function

In addition to the form of the twins' communication, its function was also analyzed. Would the kinds of input available to the twins differentially affect the development of pragmatic function? Would the added vocal dimension highten the communicative effectivness of the hearing twin, i.e., result in earlier control of more functions? If so, would the effects be generalized or restricted to a few aspects, such as questions?

The transcripts were coded for pragmatic function (see transcript sample 7/2/80). Each twin utterance was categorized as one of eight major types: performative, request, responses (behavioral and verbal), description, statement, conversational device or miscellaneous (unclassifiable). Data for this comparison of pragmatic functions are contained in Summary 2. Generally, there is a remarkable similarity between the twins in both the types of functions expressed and the proportions among functions (%T) in their communications once the higher frequency of her utterances has been taken into account. Request (category 2) is by far the most expressed communicative function ($>$33%) for both twins at all time periods. Functions with a substantial nonverbal component, i.e. performatives (c1), and compliant/noncompliant behavioral responses to requests or questions (c3) were low in frequency of occurrence ($<$10%) compared to verbal functions for both twins. The former also tended to decrease in frequency over the time of study (except during a TR tantrum at 22 months). The more verbal categories of response to requests or questions (c4) and statements of agreement or disagreement (c6) were somewhat higher in frequency at 16-18 months for both twins and, further, they remained fairly stable over the remainder of the study. When the twins are compared on the ratio of these nonverbal/verbal categories, the deaf male exhibits higher percentages of nonverbal communication (c1 and 3) than his hearing female twin while she exhibits comparatively higher percentages of verbal communication (c4 and 6) than he does.

The categories of description (c5) and conversational device (c7) were used moderately by both twins (10-25%) and increased for both from the ages 16 to 24 months. For both of these functions, the deaf male's percentage of use is higher than that of his hearing twin at 16-18 months

and remains so through 22-24 months. However, this gap narrows over time especially in use of conversational devices. The frequency of unclassifiable utterances (c8) is low and generally decreases for both twins over time except for TM at 22-24 months. This last increase can be attributed to an increase in his attempts at vocal communication.

Though general patterns of communication, as expressed by pragmatic function, are similar for the twins during the period studied, there are differences between the twins with regard to variety within functional categories. This can be seen by examining the percent of occurrences within each functional category attributed to the most frequent form of subfunction (%F). Categories 3 and 6, behavioral responses and statements, had only two subfunctions each and so were not further analyzed. Performatives (c1) were almost always either greetings or games for both twins. Verbal responses to questions (c4) were always to wh or yes/no types. No occurences were noted of responses to adult requests for clarifications or choice. The percentage of requests (c2) for objects and actions was always very high for both twins and very consistent over time. The exception was TR at 19-21 months when a hide and seek activity elicited many information-seeking requests from TR. Overall frequencies of these various requests ranked highest to lowest were: object, action, attention, information. In the categories of description (c5) and conversational device (c7) the deaf male used more variety at a younger age than his hearing twin though in both cases the differences which existed were minimal by age 24 months. Overall frequencies of these various descriptive subfunctions, highest to lowest, were: referent and location about equal, then discuss self and discuss other about equal, then property and possession, both with few instances. The two most frequent conversational devices for both twins were

acknowledgement and directing attention, followed by offer (continuer was never noted). The difference between the twins unclassifiable utterances (c8) is consistant with the results of the mode analysis: Those of the deaf male twin until 22-24 months were all of a manual nature while those of his hearing female counterpart were predominantly vocal productions.

DISCUSSION

The analysis of the data from the first year of this longitudinal study illustrates both the constancy of language processes and the uniqueness of this study's situation and subjects. In general, considering testing results and language productions, the twins appear to be somewhat delayed in certain aspects of language development, even compared to deaf norms. Appearance of the first sign was late and, at age two, except for what might be labeled better as successive utterances, they produce fewer multi-unit utterances than might be anticipated. Since the volume of parent-child communication also seems low (in data and casual observation) this delay may be due to effects of "twinning" as described by Lytton (1980). The volume of communication which might be expected from parents to a single offspring is adversely affected first by their reduced time for social interaction and then further by the twins sharing of interactive language opportunities actually afforded by the parents. Another quantitative finding was the comparatively greater amount of communication to and from the hearing female. Since hearing status compounds possible sex differences, it simply should be noted that this phenomenon seems to correlate with a more generalized perception of differences between the twins operational styles: He takes, she asks. Further evidence of this difference lies in the comparative frequency of nonverbal versus verbal categories of pragmatic function.

The analysis of communication mode corroborates and extends existing knowledge on code switching. The low ratio of vocal/manual communication to the profoundly deaf male and the higher ratio to the hearing female each follow established patterns of parental adjustment to child language (Berko & Gleason, 1973; Schiff-Meyers, 1982). However, it is interesting to see multifaceted adjustment (mode and level, if not yet language) in a single conversation. (One could speculate that the drop in vocal/manual ratio to TR by 24 months represents adult adjustment to a formally undiagnosed hearing loss.) While it is too early yet for the children to be code switching between ASL and English (Priesler, 1981), the beginnings of requisite behaviors are in evidence, especially with TR in her apparent discrimination between interactors on the basis of communication modality. Whether this mode switching was facilitated by her hearing status and whether her apparent lead in making such adjustments has later consequences must await future analysis.

In terms of pragmatic function, the twins' performance was very similar and similar to what we know of deaf and hearing children generally (Curtiss, et al., 1979; Hoffmeister, 1982). The similarity between twins seems particularly noteworthy in light of the striking differences between them in both amount and modality of communication. The functional analysis revealed a gradually increasing sophistication of each twin as an interactor during the period from 16-24 months. These longitudinal data show a shift from early nonverbal responding to a greater frequency of response accompanied by language, along with decreasing uninterpretable responses and increasing variety and use of conversational devices. Although throughout the sample period both twins responded to prompts of interactors questions, the actual responses (not frequencies) over time become increasingly more linguistically

appropriate. Some evidence of this is the growing use of statements of agreement and disagreement (yes-no questions) and different types of description (wh questions).

Results from this study may not be of value in their generalization to a larger deaf population. Nor are they yet ready to be translated into intervention strategies for working with young deaf children. But they do pose interesting questions for data analyses of later months and for other research. The next step in analysis will be to determine the patterns of interaction between modality and function for the various adult-child pairs. Are certain functions limited to specific modalities with specific interactors?

Most deaf classes consist of a hearing teacher and deaf students. Another very important question then is the role of hearing status in facilitating the development of listener accommodation. A related issue is the possible practical opposition of a teacher's recognition of the importance of speech with young deaf children to the natural tendency of adult communicators to adjust register (in this case modality) to suit perceived existing (potential) language abilities of a child listener.

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GENERAL TRANSCRIPTION CODE

SIGN	upper case manuscript = manual only (English glosses)
"speech"	lowercase in quotation = vocal only
"SIGN"	uppercase in quotation = sign and voice simultaneously
F-I-N-G-E-R	uppercase with dashes = fingerspelling
LOOK-FOR	multiple English gloss for a single sign
$\widehat{\text{BROTHER}}$	compound sign for a single English gloss followed by components e.g. $\widehat{\text{BROTHER}}$ (boy same)
$\widehat{\text{NEXT WEEK}}$	Complex sign for multiple English gloss
multiple meaning signs	use best English gloss for the context
indexing	glossed as appropriate for the content followed by explanation e.g., THOSE (repeated lateral index); YOU AND I (dual index)
YES^{H} NO^{H}	indicate unaccompanied affirmative/negative head movements
( )	contain approximate glosses and descriptions of nonlexicalized GESTURES; number of repetitions of previous sign; variations from citation form of a sign; clarifications of signs as required.
SIGN^{R} SIGN^{L}	designate hand executing the sign (where this is significant)
...	significant pause within an utterance
?	questioning intonation (holding or raising the previous sign, raised-furrowed eyebrows, etc.)
/	end of utterance, hands return to neutral or resting position
interactors	identified at beginning of transcript, specified by initials for each utterance
$\longrightarrow$	direction of address, "speaker" to "listener" (S→L)
eye contact	+ contact made, - not made, 0 undetermined, as superscript to addressee

Individual Simultaneity

x
x — simultaneous execution of two signs or sign and speech
e.g., BOY dominant hand e.g., "daddy" spoken
ME nondominant hand FATHER signed

x
x——— nondominant hand sustains sign while dominant hand executes additional signs

x——— dominant hand sustains sign while nondominant
x hand executes additional signs

x x x
x——— signs initially (or finally) simultaneous, remainder of sequence marked by one hand sustaining while the other hand executes additional signs

Interactive Simultaneity (also labeled "overlapping)"

In addition to other notations:

---------- pause during which another interactor signs

{ simultaneously executed utterances of two or more interactors (may extend to include continuations)

Sample transcriptions: (P = parent, C = child)

{P → C^{+}: "WHAT's YOUR NAME?"/
{C → P^{+}: ----------MY "NAME" K-R-I-S/

{P → C^{+}: "TOMORROW WE will GO to VISIT
{C → P^{+}: ----------TOMORROW----------
{P con't ^{0}: GRANDMOTHER .... GRANDMOTHER"/
{C con't ^{0}: ----------GRANDMOTHER /
GO

P → C^{+}: YES^{H} GO "GRANDMOTHER's"/
C → P^{-}: TOMORROW HAPPY/

CSS NAME Terri (TR) Timmy (TM) AGE 15.5 months DATE 7/2/80 Pg 5 of 38

SETTING Home INTERACTORS Dad (D) Mom(M) Marti (MAG) Cheryl (CAA) Ann (AJ)

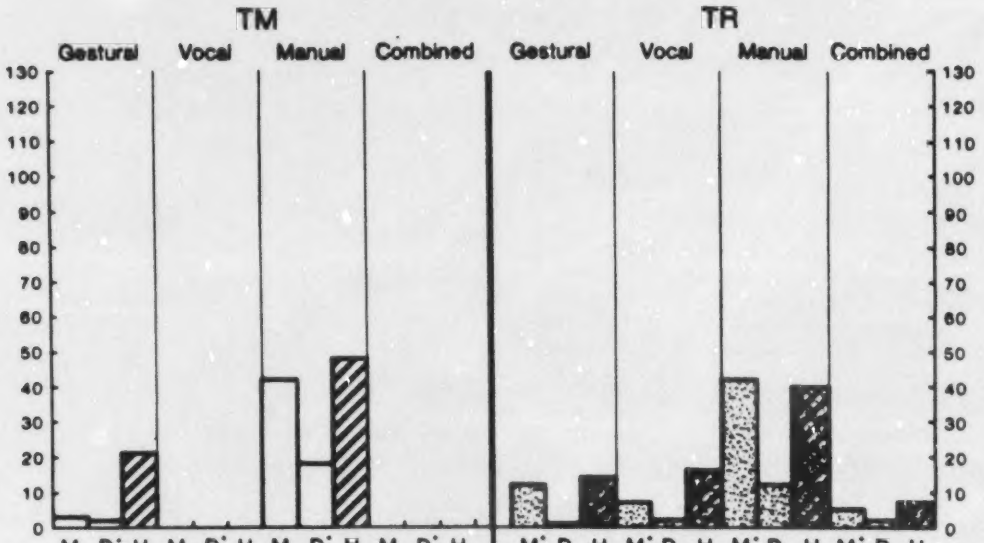
Context	Utt.No. TR	TM	Interchanges	MODALITY ANALYSIS
M waves (off camera) and children look.			M → TM, TR^{O}: ATTENTION GETTER (waves in air)	
			M con't: EAT (5)/	MO
TR goes to D. TM pulls candy from his mouth and looks at it.			D → TR^{O}: "eat" (off camera)/	VO
	4		TR → D^{+}: THAT (index candy)/	MO
			D → TR^{+}: "EAT" (3, baby index form)/	VM
[D molds EAT on TR.]			D → TR^{+}: EAT EAT (on TR with TR hand,	
			D con't: repeated each time)/	MO
TR turns toward M.			D → TR—: ATTENTION GETTER (2, taps TR)	
[Each time D signs TR reaches for candy;			D con't: EAT (4, baby index form)/	MO
When she does D takes her hand and molds	5		TR → D^{O}: THAT (reaches for candy)/	mo
EAT on her (can't be seen well by camera) -			D → TR^{O}: "eat" / (off camera while molding?)	VM
continues through multiple rounds here].			D → TR^{+}: EAT (2) "eat——"	VM
			EAT (2)	
TM joins TR and D, reaches for candy.			D → TM^{+}: "EAT" (3)/	VM
[D molds sign on TM.]			D → TM^{+}: "EAT" (on TM in TM hand, repeatedly)/	VM
D comments that this sign is "NEW."				
			D → TM^{-}: ATTENTION GETTER (taps TM)/	GES
Both children reach for candy again.		6	TM → D^{-}: THAT (reaches for candy)/	MO
	6		TR → D^{-}: - - THAT (reaches for candy)————/	MO
			D → TM^{+}: - - - - - "EAT" (on TM with TM's hand,	
			D con't: repeatedly)/	VM
D closes bag, starts to walk away ...		7	TM → D^{-}: EAT/	MO
D has given bag of candy to M.				
M takes a candy from bag.			M → TM^{+}: EAT CANDY 2 3/	MO
		8	TM → M^{+}: - - - THAT (reaching for bag)—/	MO
M starts to give TM candy, TR reaches into bag.				
M lifts bag away, gives candy to TM as TR watches.			M → TM^{-}: ATTENTION GETTER (taps TM) THANK YOU/	GES
TR reaches again for bag (vocalizes).	7		TR → M^{-}: "THAT" ("approx.," reaches for candy bag)/	VM
M takes candy from bag for TR.			M → TR^{+}: "eat————eat————eat————"/	VM
(vocalization approximately "eed")			EAT 2 3 4 5 6 7 8 /	
	8		TR → M^{+}: - - - - - - - - THAT (reaching for bag)——/	MO
M gives candy to TR.				

CSS NAME Timmy (TM) Terri (TR) AGE 23.5 months DATE 2/25/81 Pg 21 of 25

SETTING Home INTERACTORS Mom (M), Dad (D), Marti (MAG), Neighbor (NB)

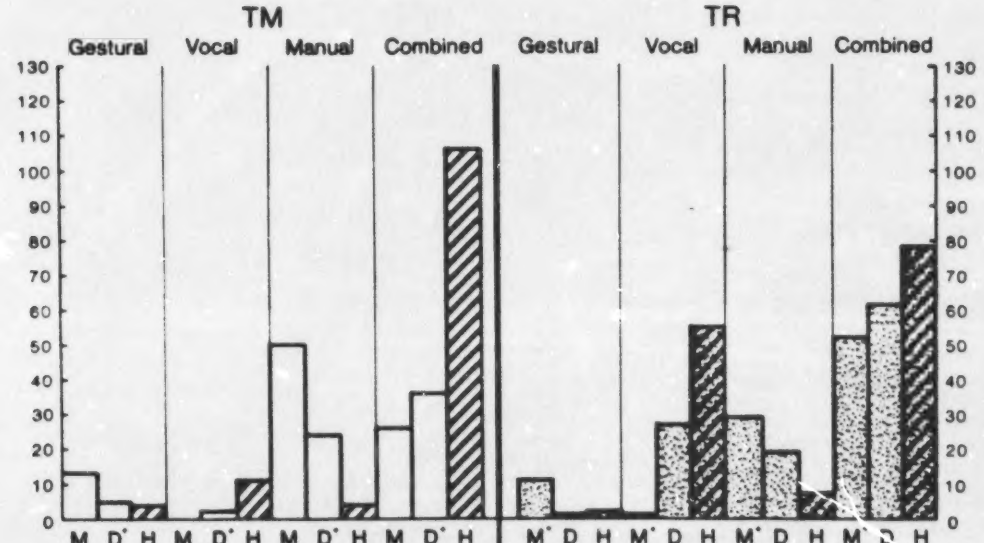
Context	Utt.No. TR	Utt.No. TM	Interchange	PRAGMATIC ANALYSIS
MAG attempts to blow up another balloon.			MAG → TM^{+}: "i CAN'T"/	
		35	TM → MAG^{+}: QUESTION GESTURE^{R} (palm raised, 2)/	RIN
MAG stretches balloon.			MAG → TM^{+}: "MAKE it BLOW up"/	
		36	TM → MAG^{-}: GESTURE^{R} ("blow"- S hand contacts mouth)/	ACK
MAG blows up balloon.	86		TR → MAG^{-}: THAT^{L} (arm extend to balloon)/	ROB
			MAG → TM^{+}: "this one's FOR YOU"/	
		37	TM → MAG^{+}: ME^{R} (index chest) ME^{R} (index chin, 3)/	ACK
			MAG → TR^{+}: "FOR HIM" (index TM)/	
	87		TR → MAG^{+}: THAT^{R} (arm extends to balloon)———/	ROB
MAG gives TM the balloon.				
TM tries to bite the balloon.			MAG → TR^{+}: "you want one?"/	
	88		TR → MAG^{-}: THAT^{R} (excitedly indexes balloon)/	YNR/ROB
MAG holds out another balloon.			MAG → TR^{-}: "want this one?"/	
	89		TR → MAG^{-}: THAT^{L} (arm extend to balloon) EAT	YNR/DIS
			MAG → TR^{+}: ---- "THIS (index balloon) this is RED	
			TR con't: (standard, 2) MORE (standard, 4) BALLOON	
			MAG con't: ..... RED" ... BALLOON/	
			TR con't: (O-hands to mouth, index edge^{R} strokes	
			TR con't: mouth, 2; back of hand^{R} contacts mouth, head	
			TR con't: tilts back - like TM's DRINK sign)/	
MAG stretches balloon.			MAG → TM^{+}: "READY?"/	
TM holds his blown balloon to his mouth.		38	TM → ?: YES^{H}/	YNR/SAD
MAG begins blowing up balloon.	90		TR → MAG^{-}: THAT^{L} (arm extend to balloon) ...	CDA
			TR con't: ATTENTION GETTER^{L} (taps MAG)/	
			MAG → TR^{-}: "WHOSE? ... hey terri ... WHOSE?	
			MAG con't: ... WHOSE? ... this YOURS?"/	
	91		TR → MAG^{+}: EAT^{L} (standard, 1) ... EAT^{L} (same, 1)	WHR/DIS
			MAG → TR^{-}: ----- "is that YOURS?"/	
			TR con't: MORE (standard, 9)/	
	92		TR → TM: ATTENTION GETTER^{L} (waves at TM)	SGN
			TR con't: ... YOU^{R} (index TM)/	
MAG blows up the balloon.				
MAG hits balloon into air.				
TR tries to catch it.				
TR gets balloon, squeezes it and breaks it.				

Expressive (16-18 mos.)



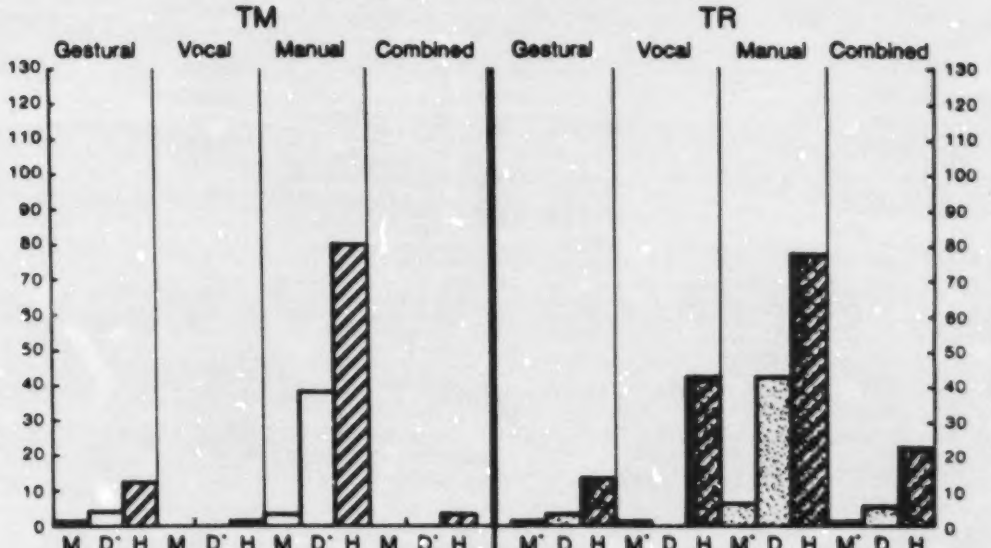
%I = of individual
%T = of total

Receptive (16-18 mos.)



%I = of individual
%T = of total

Expressive (19-21 mos.)



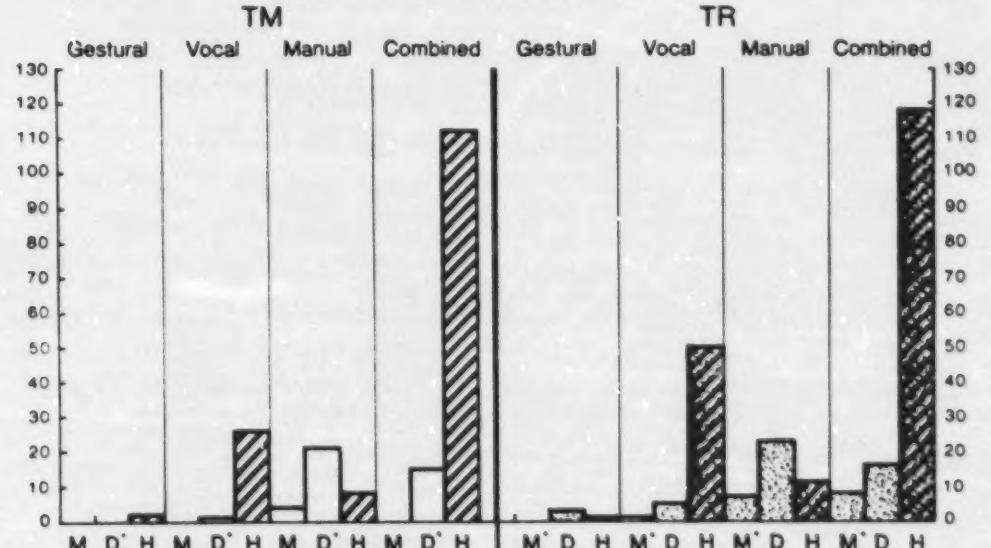
	TM												TR											
%I	25	10	13	0	0	1	75	90	83	0	0	3	11	6	8	11	0	27	67	84	50	11	10	14
%T	7	3	8	0	0	7	2	27	56	0	0	2	4	1	6	4	0	20	3	20	36	4	2	10

Total = 142 M = 4 D = 42 H = 96

Total = 213 M = 9 D = 50 H = 154

%I = of individual
%T = of total

Receptive (19-21 mos.)



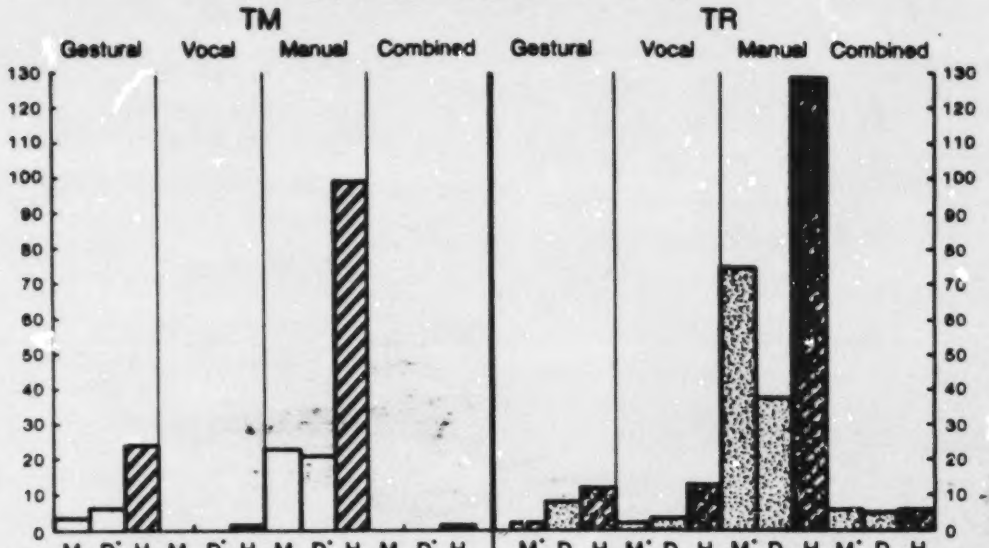
	TM												TR											
%I	0	0	1	0	3	18	100	57	5	0	41	76	0	6	5	6	11	28	44	49	6	50	34	66
%T	0	0	1	0	5	14	2	12	4	0	8	59	0	1	4	4	2	21	3	9	5	3	7	49

Total = 189 M = 4 D = 37 H = 148

Total = 243 M = 16 D = 47 H = 180

%I = of individual
%T = of total

Expressive (22-24 mos.)



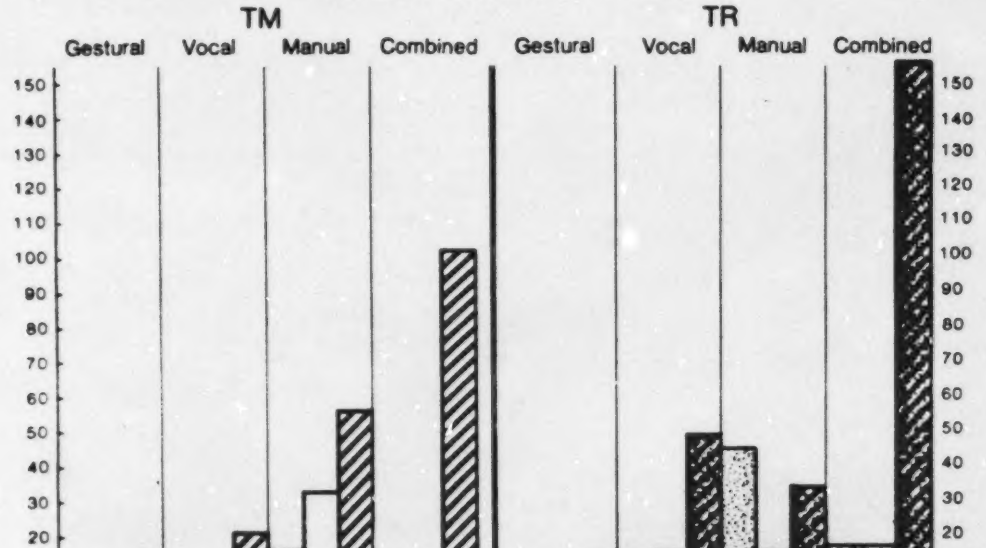
	TM												TR											
	M	D*	H	M	D*	H	M	D*	H	M	D*	H	M*	D	H	M*	D	H	M*	D	H	M*	D	H	
%I	12	22	19	0	0	8	88	78	79	0	0	8	2	15	8	2	6	8	88	70	81	7	9	4	%I
%T	2	3	13	0	0	5	13	12	57	0	0	5	7	3	4	7	1	4	25	13	43	2	2	2	%T

Total = 178 M = 26 D* = 27 H = 125

Total = 299 M* = 85 D = 54 H = 160

%I = of individual
%T = of total

Receptive (22-24 mos.)



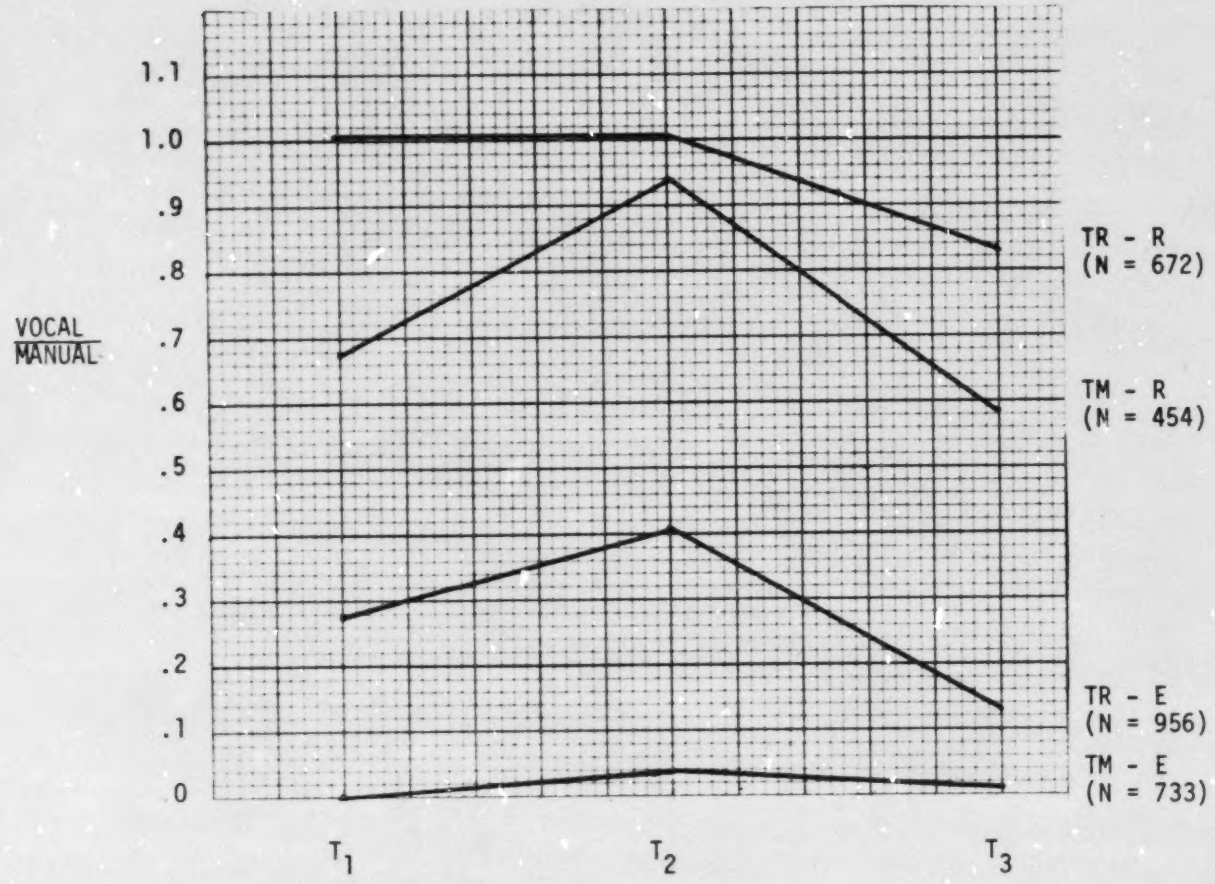
	TM												TR											
	M	D*	H	M	D*	H	M	D*	H	M	D*	H	M*	D	H	M*	D	H	M*	D	H	M*	D	H	
%I	3	7	6	0	3	11	52	80	29	45	10	53	1	13	5	1	28	19	70	28	13	27	31	62	%I
%T	3	1	5	0	3	8	6	13	21	5	2	39	2	2	4	2	4	13	12	4	9	5	5	42	%T

Total = 263 M = 31 D* = 41 H = 191

Total = 370 M* = 64 D = 54 H = 252

%I = of individual
%T = of total

Ratio of vocal to manual communication, receptive and expressive, for each twin at the three time periods.

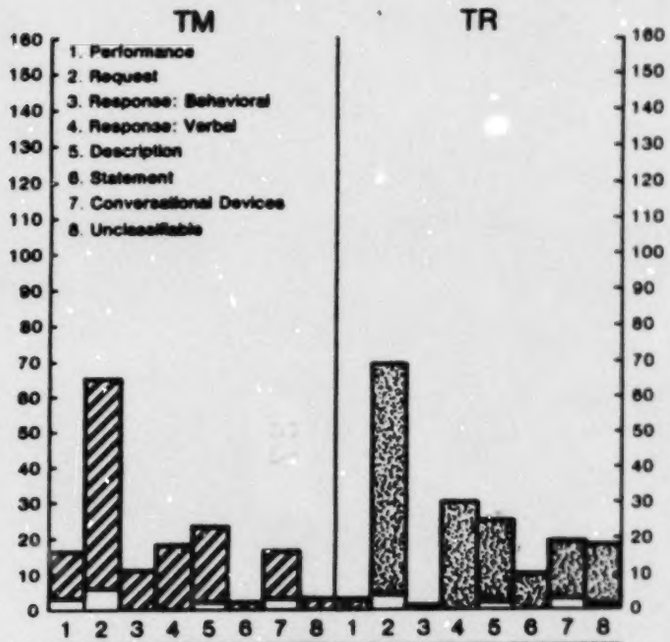


PRAGMATIC CODE

c.f. Day, Greenberg

Code	Function	Double Code	Source
	Request (for:)		
RAC	Action		D & G
ROB	Object		D
RIN	Information (Wh:)		G(D)
RCF	Confirmation (Permission, Yes/No?)		G(D)
ATN	Attention		G
	Response (to: question or request)	Double Code	
YNR	Yes/No	**	D
WHR	WH (constituent specification)	**	D
CLR	Clarification	**	D
CAR	Choice Answer (either/or)	**	G
CMP/NCP	Compliance/Noncompliance (non-verbal behavior, motor imitation)		G & D
	Description (could be response)		
REF	Identify (reference, name object/person)		D(G)
DIS	Event (discuss self-action/thought)		D(G)
DIO	Attribute (discuss other action/thought)		D(G)
DPR	Property		D
DPO	Possession		D
DLO	Location		D
	Statement (could be response)		
SAD	Evaluate (agree/disagree-verbal, approve/disapprove action)		D(G)
SEP	Explain (causality)		D
	Conversational Device		
COR	Continuer (non-verbal)		G
ACK	Acknowledgement (verbal imitation/comment)		G(D)
CDO	Offer		D
CDA	Direct Attention		D
			D
	Performative		
GRE	Greet/Parting		D & G
PPL	Polite		D
PSC	Scold		D
PWN	Warn		D
PCL	Claim		D
PRO	Protest		D
PRP	Role Play		D
PJO	Joke		D
PGM	Game		D
PAT	(Pattern)		D
	Miscellaneous		
INS	Teach/Instruct		G
	Unclassifiable		G & D
VOC	Vocalization		G
GES	Gesture		G
SGN	Sign		G

Pragmatic Function (16-18 mos.)

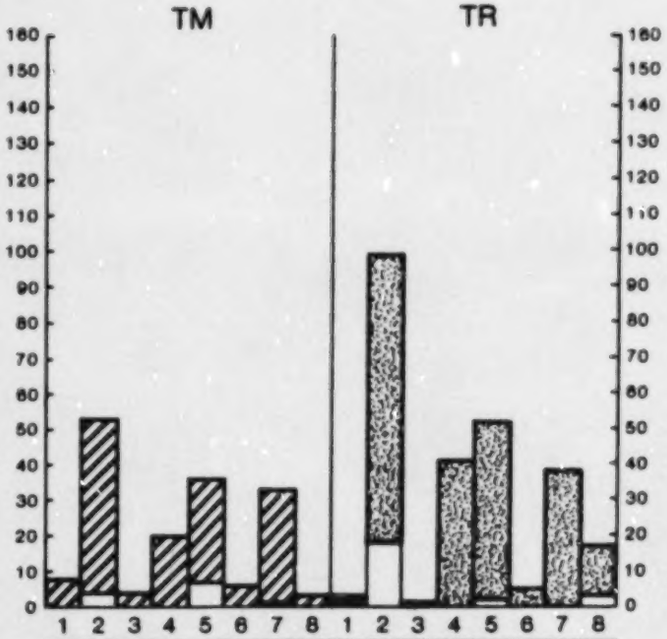

TM
TR
1. Performance
2. Request
3. Response: Behavioral
4. Response: Verbal
5. Description
6. Statement
7. Conversational Devices
8. Unclassifiable
1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8
%F 81 91 NA 100 91 NA 81 100 100 88 NA 100 92 NA 84 94 %F
%T 11 43 7 12 15 1 11 2 2 37 .5 16 13 5 10 10 %T

Total = 152 Total = 188

%F: accounted for by most frequent forms

%T: of total functions

Pragmatic Function (19-21 mos.)

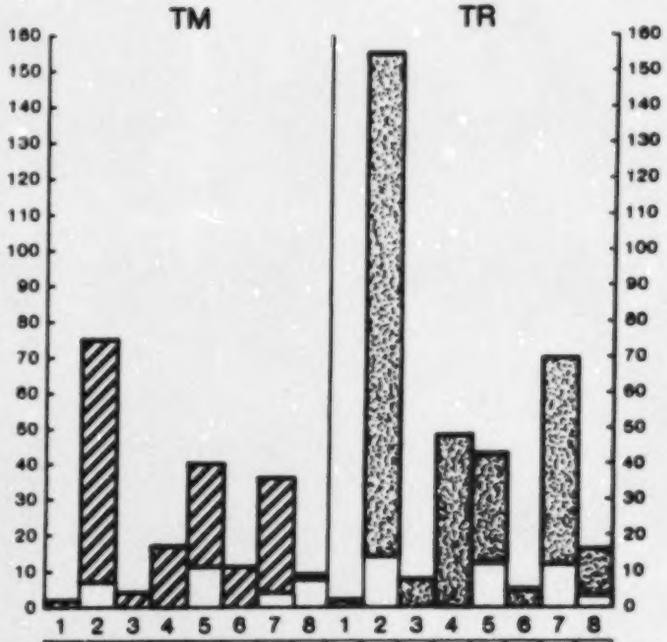


Total = 163 Total = 254

%F: accounted for by most frequent forms

%T: of total functions

Pragmatic Function (22-24 mos.)



Total = 194 Total = 347

%F: accounted for by most frequent forms

%T: of total functions